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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/833,711	04/13/2001	Luc Ouellet	10932-US	4962

23553 7590 12/29/2005

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EXAMINER	
MARKHAM, WESLEY D	

ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 12/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/833,711	OUELLET ET AL.	
	Examiner	Art Unit	
	Wesley D. Markham	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 9/15/2005 (the RCE) and 10/25/2005.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-3,6,8 and 10-24 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-3,6,8 and 10-24 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 13 April 2001 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application on 9/15/2005 after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action, mailed on 6/16/2005, has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/25/2005 has been entered.

Response to Amendment

2. Acknowledgement is made of the amendment filed by the applicant on 10/25/2005, in which (1) Claims 1, 2, 6, 8, 12, 14, 15, and 19 – 23 were amended, and (2) Claims 5, 7, and 25 – 27 were canceled. **Claims 1 – 3, 6, 8, and 10 – 24** remain pending in U.S. Application Serial No. 09/833,711, and an Office action on the merits follows.

Drawings

3. Upon further consideration, the drawings filed on 4/13/2001 are objected to because the word "gas" in Figures 13 and 14 is misspelled "gass". Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended

drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

4. The objection to Claim 7 set forth in paragraph 7 of the previous Office action <u>is withdrawn</u> in light of the applicant's amendment to cancel Claim 7.
5. **Claim 1** is objected to because of the following informalities: Amended Claim 1 requires, in part, "wherein said silica films are deposited by plasma enhanced chemical vapor deposition (PECVD) at temperature between 100 and 650°C..." The aforementioned phrase appears to contain a typographical error (i.e., the word "a" appears to be missing between the words "at" and "temperature"). Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. The rejections of Claims 1 – 3, 5 – 8, and 10 – 27 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention, set forth in paragraphs 10 – 12 of the previous Office action, are withdrawn in light of the applicant's amendments to clarify the numerous "antecedent-basis" issues raised by the examiner.

8. Claims 1 – 3, 6, 8, and 10 – 20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

9. Amended independent **Claim 1**, from which **Claims 2, 3, 6, 8, and 10 – 20** depend, requires, in part, "subjecting the deposited silica films to a low temperature treatment between 400° to 1200°C to minimize the presence of contaminant compounds in said film" (see step c) of the claim). This limitation renders the scope of the claims unclear because "said film" in the aforementioned limitation lacks clear antecedent basis in the claim. For example, it is clear that "silica films" (plural) are deposited by the claimed method. However, it is unclear to which of the plural silica films "said film" refers in the context of the claimed invention.

10. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

11. The rejections of Claims 1 – 3, 5 – 8, and 10 – 27 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement, set forth in paragraphs 14 – 16 of the previous Office action, <u>are withdrawn</u> in light of the applicant's amendments to (1) remove the limitation requiring depositing the plurality of silica films on the same substrate (i.e., "said substrate") from the claims, and (2) specifically refer to observing the FTIR characteristics of the deposited silica films instead of generally referring to observing the "optical characteristics" of the films.

12. Claims 21 – 23 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contain subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention.

13. Amended independent **Claim 21**, from which **Claims 22 and 23** depend, requires, in part, fixing the flow rate of the silicon-containing gas, the oxygen-containing gas, and the carrier gas at about 0.2 SLM, 6.0 SLM, and 3.15 SLM, respectively. However, the originally filed specification only disclosed or suggested using the

aforementioned specific gas flow rates for SiH_4, N_2O, and N_2, respectively (see original Claims 13 and 15 – 18; pages 30 – 31 of the specification), not for the broad genus of a silicon-containing gas, an oxygen-containing gas, and a carrier gas now claimed by the applicant. There is no explicit, implicit, or inherent teaching or suggestion in the originally filed specification that the flow rates specifically disclosed for SiH_4, N_2O, and N_2 gases (i.e., 0.2 SLM, 6.0 SLM, and 3.15 SLM, respectively) could or should be used in the claimed method for other combinations of different silicon-containing gas(es), oxygen-containing gas(es), and/or carrier gas(es). The examiner's position is supported by the applicant's specification at page 34, lines 6 – 7, which states that a different set of coordinates could be found for other alternate chemistries. Therefore, the specification suggests that different coordinates (e.g., gas flow rates and deposition pressure) are used depending on what process gases are used. Please note that dependent Claim 24 has not been rejected on this basis because it specifically requires that the silicon-containing gas be SiH_4, the oxygen-containing gas be N_2O, and the carrier gas be N_2.

Double Patenting

14. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting

claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., In re Berg, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); In re Goodman, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); In re Longi, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); In re Van Ornum, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); In re Vogel, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and In re Thorington, 418 F.2d 528, 163 USPQ 644 (CCPA 1969). A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

15. **Claims 21, 23, and 24** are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1 – 19 of U.S. Patent No. 6,887,514 (Ouellet et al.). Although the conflicting claims are not identical, they are not patentably distinct from each other because Claims 1 – 19 of ‘514 teach all of the limitations of Claims 21, 23, and 24 of the instant application, thereby motivating one of ordinary skill in the art to perform the process of Claims 21, 23, and 24 of the

instant application (i.e., when performing the process of Claims 1 – 19 of '514). Specifically, Claims 1 – 19 of '514 teach a method of making silica waveguides (i.e., an optical quality silica film on a substrate) (Claims 1 and 11 of '514) wherein the silica film is deposited at a temperature between 100 and 650° C, specifically 400° C (Claim 10 of '514) by PECVD in the presence of SiH_4, N_2O, and N_2 gases (Claims 1, 2, 11, and 13 – 15 of '514), the aforementioned gases having fixed flow rates of 0.2 SLM, 6.0 SLM, and 3.15 SLM, respectively (Claims 3 and 19 of '514), depositing the silica film on the substrate at a total deposition pressure of about 2.6 Torr (i.e., a value that overlaps with the applicant's claimed value of "about 2.4 Torr") (Claim 4 of '514), and subjecting the deposited silica film to a low temperature treatment at about 800° C (Claims 5 – 8 and 16 – 18 of '514). While the claims of '514 do not explicitly teach that the heat treatment is performed "to minimize the presence of Si-Ox-Hy-Nz compounds", the silica film deposition conditions and heat treatment conditions taught by the claims of '514 are identical to the deposition and heat treatment conditions claimed and disclosed by the applicant. As such, the heat treatment of the claims of '514 would have inherently minimized the presence of Si-Ox-Hy-Nz compounds in the silica film.

16. **Claims 21, 23, and 24** are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over Claims 1 – 20 of U.S. Patent No. 6,716,476 (Ouellet et al.). Although the conflicting claims are not identical, they are not patentably distinct from each other because Claims 1 – 20 of '476 teach all of the

limitations of Claims 21, 23, and 24 of the instant application, thereby motivating one of ordinary skill in the art to perform the process of Claims 21, 23, and 24 of the instant application (i.e., when performing the process of Claims 1 – 20 of '476). Specifically, Claims 1 – 20 of '476 teach a method of making an optical quality silica film on a substrate (Claims 1, 15, 17, and 18 of '476) wherein the silica film is deposited at a temperature between 100 and 650° C, specifically 400° C (Claims 3 and 4 of '476) by PECVD in the presence of SiH_4, N_2O, and N_2 gases (Claims 1, 6 – 8, and 15 of '476), the aforementioned gases having fixed flow rates of 0.2 SLM, 6.0 SLM, and 3.15 SLM, respectively (Claims 11 and 15 of '476), depositing the silica film on the substrate at a total deposition pressure of about 2.6 Torr (i.e., a value that overlaps with the applicant's claimed value of "about 2.4 Torr") (Claims 12, 14, and 15 of '476), and subjecting the deposited silica film to a low temperature treatment at about 800° C (Claims 2 and 15 of '476). While the claims of '476 do not explicitly teach that the heat treatment is performed "to minimize the presence of Si-Ox-Hy-Nz compounds", the silica film deposition conditions and heat treatment conditions taught by the claims of '476 are identical to the deposition and heat treatment conditions claimed and disclosed by the applicant. As such, the heat treatment of the claims of '476 would have inherently minimized the presence of Si-Ox-Hy-Nz compounds in the silica film.

17. **Claim 22** is rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over (1) Claims 1 – 19 of U.S. Patent No.

6,887,514, and (2) Claims 1 – 20 of U.S. Patent No. 6,716,476, in view of Chandross et al. (USPN 4,708,884). Specifically, both Claims 1 – 19 of U.S. Patent No. 6,887,514, and Claims 1 – 20 of U.S. Patent No. 6,716,476 teach all the limitations of Claim 22 of the instant application as set forth above in paragraphs 15 and 16, except for a method wherein the pressure is maintained by a vacuum pump having a controllable pumping speed, and the total gas pressure is maintained by controlling the pumping speed. The claims of '514 and '476 are silent as to how the appropriate chamber pressure is maintained. Chandross et al. teaches that it was known in the art of silicon oxide deposition at the time of the applicant's invention to maintain the desired pressure in a vacuum chamber by controlling the pumping speed of a vacuum pump (Col.5, lines 48 – 60). Therefore, it would have been obvious to one of ordinary skill in the art to maintain the desired pressure during the PECVD process by controlling the pumping speed of a vacuum pump, as taught by Chandross et al., with the reasonable expectation of successfully and advantageously maintaining the desired pressure by utilizing a well-known, conventional means of doing so. Please note that art-recognized suitability for an intended purpose (in this case, the suitability of a controllable vacuum pump for maintaining the pressure in a vacuum chamber) supports a *prima facie* obviousness determination (MPEP 2144.07)

Claim Rejections - 35 USC § 103

18. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

19. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

20. Claims 1, 2, 8, 13 – 17, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouffard et al. (USPN 5,409,743) in view of Hsieh et al. ("Characteristics of low-temperature and low-energy plasma-enhanced chemical vapor deposited SiO_2", 1993).

21. Regarding independent **Claim 1**, Bouffard et al. teaches a method of optimizing the characteristics of borophosphosilicate glass (BPSG) films (i.e., "silica films", as required by the claims) (Abstract, Figure 2, Col.1, lines 6 – 16, and Col.2, lines 29 – 32), wherein the silica films are deposited by PECVD (Abstract, Figure 2, Col.2, lines 29 – 32) at a temperature between 100 and 650° C (Col.4, lines 59 – 60, Col.5, lines 15 – 20) in the presence of a silicon-containing gas, an oxygen-containing gas, and a carrier gas, each of the gases having a flow rate (Figure 2; Col.4, line 36 – Col.5,

line 20), the method comprising setting the flow rates of the silicon-containing gas, the oxygen-containing gas, and the carrier gas as respective predetermined fixed values and depositing silica films at different total deposition pressures of the gases between 2.0 and 2.6 Torr at the predetermined fixed values (Col.4, line 36 – Col.5, line 20; Figure 2, which depicts four sets of trials (1 and 5; 2 and 6; 3 and 7; 4 and 8) in which all of the gas flow rates are fixed at predetermined values and only the total deposition pressure changes from 2.20 to 2.60 Torr), subjecting the deposited silica films to a low temperature treatment between 400° C to 1200° C (Col.1, lines 8 – 11, Col.3, lines 30 – 32, Col.5, lines 30 – 43), and depositing an optimized silica film by controlling the total deposition pressure to the previously determined optimum total deposition pressure (Col.5, lines 1 – 20 and 30 – 34). Bouffard et al. does not explicitly teach that the annealing (i.e., the low temperature treatment) is performed "to minimize the presence of contaminant compounds in said film". However, Bouffard et al. teaches all of the process steps used to produce the silica films claimed by the applicant, including the specifics of the PECVD process (i.e., substrate temperature, reactant gas, oxidation gas, total gas pressure, etc.) and the heat-treatment process (i.e., temperature). Therefore, the combined deposition / annealing process of Bouffard et al. would have inherently produced an optical quality silica film and minimized the presence of contaminant compounds such as Si-O-H-N in the film. The examiner's position is supported by Ojha et al. (USPN 5,904,491), which teaches that annealing a PECVD-produced silica film reduces contaminant compounds in the film (Cols.1 and 3). Additionally, please note that the

mere observation of still another beneficial result (i.e., that annealing a PECVD silica film reduces contaminants in the film) of an old process cannot form the basis of patentability (*Allen et al. v Coe*, 57 USPQ 136). Bouffard et al. does not explicitly teach observing the FTIR characteristics of the deposited films to determine the optimum total deposition pressure. However, Bouffard et al. does teach using a variety of analytical methods, including optical emission spectroscopy, spectrophotometry, and ion chromatography, to determine the characteristics and quality of the deposited silica films and to optimize the PECVD process parameters, including total deposition pressure (Col.4, line 63 – Col.5, line 20). Hsieh et al. teaches that, in the art of depositing silica films by PECVD from silane and N_2O reactants (i.e., a process analogous to that of Bouffard et al.), the more important variables that affect the electrical and physical properties of the deposited films include total flow rate of the reactants and chamber pressure (page 2639, col.2). Hsieh et al. also teaches using FTIR to analyze the composition and chemical bonds present in the deposited silica films (page 2638, col.2; page 2639, col.1; page 2642, col.2). Therefore, it would have been obvious to one of ordinary skill in the art to analyze the silica films deposited by Bouffard et al. with FTIR in order to reap the benefits of doing so, such as determining the composition and chemical bonds present in the films, as desired by Bouffard et al., and using this information (e.g., along with the information obtained by the optical emission spectroscopy, spectrophotometry, and ion chromatography analytical methods taught by Bouffard et al.) to optimize the PECVD process variables. Regarding **Claim 2**, Bouffard et al.

does not explicitly teach that the total deposition pressure is controlled to minimize the presence of Si-O-H-N compounds as evidenced by the FTIR characteristics. However, the total pressure taught by Bouffard et al. (e.g., 2.4 to 2.6 Torr – see Col.5, lines 9 – 11) is in the preferred range of pressures disclosed and claimed by the applicant (see, for example, applicant's Claim 1). Therefore, since the total pressure taught by Bouffard et al. is in the range of pressures claimed by the applicant, the total pressure in Bouffard et al. is inherently controlled "to minimize the presence of Si-O-H-N compounds". Please note that the mere observation of still another beneficial result (i.e., that a certain range of PECVD silica deposition pressures provides reduced contamination of the silica film) of an old process cannot form the basis of patentability (*Allen et al. v Coe*, 57 USPQ 136). Bouffard et al. also teaches a deposition temperature of about 400° C (**Claim 8**) (Col.4, lines 59 – 60, Col.5, lines 15 – 17); the applicant's claimed gases (i.e., SiH_4, N_2O, and N_2) and optimized flow rates (**Claims 13 – 17**) (Figure 2; Col.4, line 44 – Col.5, line 20); and incorporating modifiers such as boron and/or phosphorous during deposition to modify the resulting refractive index (**Claims 19 and 20**) (Table 2; Col.4, line 10 – Col.5, line 24).

22. Claims 3, 18, 21, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouffard et al. in view of Hsieh et al., in further view of Ojha et al. (USPN 5,904,491).

23. The combination of Bouffard et al. and Hsieh et al. teaches all the limitations of **Claims 3, 18, 21, 23, and 24** as set forth above in paragraph 21, except for a method wherein (1) the flow rate of the carrier gas (e.g., N_2) is 3.15 SLM, and (2) the annealing is performed at about 800° C. Regarding issue (1), Bouffard et al. teaches an N_2 flow rate of about 1.59 SLM (value obtained from the flow rate information provided on Col.4, lines 54 – 59 of Bouffard et al.; calculations are omitted). Hsieh et al. teaches that a high flow rate of carrier gas is desirable in a PECVD process utilized to deposit silica from silane and nitrous oxide because it produces a high quality film (Abstract and pages 2638 – 2641). Further, Hsieh et al. teaches that variables such as total gas flow rate and carrier gas flow rate affect the electrical and physical properties of the deposited films (page 2639, section III.). Therefore, it would have been obvious to one of ordinary skill in the art to utilize a high carrier gas (e.g., He or N_2 – page 2641, col.1) flow rate, such as a rate of 3.15 SLM, in the process of Bouffard et al. because Hsieh et al. teaches that a high flow rate of carrier gas is desirable in a PECVD process utilized to deposit silica from silane and nitrous oxide. The exact value of the nitrogen / carrier gas flow rate would have been optimized by one of ordinary skill in the art in order to achieve the desired electrical and physical properties of the deposited film, as taught by Hsieh et al. Regarding issue (2), Ojha et al. teaches that annealing a silica (e.g., BPSG) film at a temperature of, for example, 800° C after depositing the film by PECVD reduces the amount of unwanted chemical substances / elements in the film (Col.1, lines 12 – 53 and 64 – 67, Col.2, lines 1 – 10 and 58 – 65, Col.3, lines 13 – 18 and 52 – 62, and

Col.5, lines 20 – 36). Therefore, it would have been obvious to one of ordinary skill in the art to anneal the BPSG films of Bouffard et al. at a temperature in the range(s) taught by Ojha et al. after PECVD in order to reap the benefits taught by Ojha et al., such as minimizing the amount of film contamination.

24. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bouffard et al. in view of Hsieh et al., in further view of Chandross et al. (USPN 4,708,884).

25. The combination of Bouffard et al. and Hsieh et al. teaches all the limitations of **Claim 6** as set forth above in paragraph 21, except for a method wherein the pressure is maintained by a vacuum pump having a controllable pumping speed, and the total gas pressure is maintained by controlling the pumping speed. Please note that the combination of Bouffard et al. and Hsieh et al. does teach depositing the film in a vacuum chamber in general, as required by Claim 6 (Col.4, lines 50 – 53 of Bouffard et al.). The combination of Bouffard et al. and Hsieh et al. is silent as to how the appropriate chamber pressure is maintained. Chandross et al. teaches that it was known in the art of silicon oxide deposition at the time of the applicant's invention to maintain the desired pressure in a vacuum chamber by controlling the pumping speed of a vacuum pump (Col.5, lines 48 – 60). Therefore, it would have been obvious to one of ordinary skill in the art to maintain the desired pressure in the vacuum chamber during the PECVD process by controlling the pumping speed of a vacuum pump, as taught by Chandross et al., with the reasonable expectation of successfully and advantageously maintaining the desired pressure (e.g., 2.4 Torr) by

utilizing a well-known, conventional means of doing so. Please note that art-recognized suitability for an intended purpose (in this case, the suitability of a controllable vacuum pump for maintaining the pressure in a vacuum chamber) supports a *prima facie* obviousness determination (MPEP 2144.07).

26. Claims 10 – 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouffard et al. in view of Hsieh et al., in further view of Hwang (EP 0 935 284 A1).

27. The combination of Bouffard et al. and Hsieh et al. teaches all the limitations of **Claims 10 – 12** as set forth above in paragraph 21, except for a method wherein the reactive gas is selected from the silicon-containing gases listed by the applicant in Claim 10. Please note that the combination of Bouffard et al. and Hsieh et al. does teach utilizing oxygen as the oxidation gas, as required by Claim 11 (Col.4, line 39 of Bouffard et al.), and He as the carrier gas, as required by Claim 12 (Abstract, pages 2638 – 2642 of Hsieh et al.). Additonally, the combination of Bouffard et al. and Hsieh et al. teaches utilizing silane as the reactive gas (Figure 2; Col.4, lines 36 – 43 of Bouffard et al.). Hwang teaches that, in a PECVD process used to deposit a silica film, utilizing disilane (Si_2H_6) as the reactive gas as opposed to silane improves the deposition rate of the film (Abstract, Tables 1 – 3, and paragraphs [0001], [0002], [0010], [0028], and [0029]). Therefore, it would have been obvious to one of ordinary skill in the art to utilize disilane as the reactive gas in the process of the combination of Bouffard et al. and Hsieh et al. with the reasonable expectation of successfully and advantageously improving the deposition rate of the film.

28. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bouffard et al. in view of Hsieh et al., in further view of Ojha et al. (USPN 5,904,491), and in further view of Chandross et al.

29. The combination of Bouffard et al., Hsieh et al., and Ojha et al. teaches all the limitations of **Claim 22** as set forth above in paragraph 23, except for a method wherein the pressure is maintained by a vacuum pump having a controllable pumping speed, and the total gas pressure is maintained by controlling the pumping speed. Please note that the combination of Bouffard et al. and Hsieh et al. does teach depositing the film in a vacuum chamber in general, as required by Claim 22 (Col.4, lines 50 – 53 of Bouffard et al.). The combination of Bouffard et al. and Hsieh et al. is silent as to how the appropriate chamber pressure is maintained. Chandross et al. teaches that it was known in the art of silicon oxide deposition at the time of the applicant's invention to maintain the desired pressure in a vacuum chamber by controlling the pumping speed of a vacuum pump (Col.5, lines 48 – 60). Therefore, it would have been obvious to one of ordinary skill in the art to maintain the desired pressure in the vacuum chamber during the PECVD process by controlling the pumping speed of a vacuum pump, as taught by Chandross et al., with the reasonable expectation of successfully and advantageously maintaining the desired pressure (e.g., 2.4 Torr) by utilizing a well-known, conventional means of doing so. Please note that art-recognized suitability for an intended purpose (in this case, the

suitability of a controllable vacuum pump for maintaining the pressure in a vacuum chamber) supports a *prima facie* obviousness determination (MPEP 2144.07).

30. Claims 21, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ojha et al. (USPN 5,904,491) in view of Ngo et al. (USPN 6,127,261).

31. Regarding **Claims 21, 23, and 24**, Ojha et al. teaches a method of depositing an optical quality silica film on a substrate (Col.1, lines 3 – 8, Col.2, lines 43 – 58, and Col.6, lines 5 – 15), the method comprising forming an optical quality borophosphosilicate glass (BPSG) (i.e., silica) film on a substrate by PECVD in the presence of gases (Col.1, lines 64 – 67, Col.2, lines 1 – 10 and 43 – 57, Col.3, lines 10 – 11, 20 – 24, and 32 – 44, and Col.4, lines 22 – 29), and subjecting the as-deposited film to a low temperature treatment between 400° C to 1200° C, specifically at 800° C, to minimize the presence of contaminant compounds in the film (Col.1, lines 12 – 53 and 64 – 67, Col.2, lines 1 – 10 and 58 – 65, Col.3, lines 52 – 62, and Col.5, lines 20 – 36). Ojha et al. does not teach the specifics of the BPSG PECVD process, such as (1) a silane flow rate of 0.2 SLM, an N_2O flow rate of 6.0 SLM, and a N_2 flow rate of 3.15 SLM, (2) a total deposition pressure of about 2.4 Torr, and (3) a deposition temperature of between 100 and 650° C, particularly 400° C. In general, Ojha et al. is silent as to the specifics of the PECVD process, except to say that the PECVD process may involve the use of <u>silane and nitrous oxide</u> as sources for silicon and oxygen, respectively, for the deposition of the waveguide material (Col.3, lines 19 – 24). Therefore, one of ordinary skill in the art would have

been motivated to seek-out and utilize PECVD process parameters that are effective in depositing a silica film from gases such as silane and nitrous oxide, as desired by Ojha et al. Ngo et al. teaches that the PECVD process recipe claimed by the applicant (i.e., a silane flow rate of 0.2 SLM, an N_2O flow rate of 6.0 SLM, a N_2 flow rate of 3.15 SLM, a total deposition pressure of about 2.4 Torr, and a deposition temperature of between 100 and 650° C, particularly 400° C) is a well-known PECVD process recipe used to deposit silica films on a substrate (Col.4, lines 13 – 31, Claims 1 – 4). It would have been obvious to one of ordinary skill in the art to utilize the PECVD process parameters taught by Ngo et al. to deposit the silica film(s) of Ojha et al. because Ojha et al. generally desires to deposit a silica film by PECVD from silane and nitrous oxide reactants and Ngo et al. teaches a specific set of process parameters (e.g., gas flow rates, deposition pressure, deposition temperature, etc.) that are used to achieve just such a goal. The combination of Ojha et al. and Ngo et al. does not explicitly teach that the annealing process minimizes the presence of Si-O-H-N compounds in the film. However, Ojha et al. teaches that the annealing process removes undesirable contaminants from the film in general (Col.1, lines 12 – 53 and 64 – 67, Col.2, lines 1 – 10 and 58 – 65, Col.3, lines 52 – 62, and Col.5, lines 20 – 36), and the combination of Ojha et al. and Ngo et al. teaches each and every process step and limitation of the applicant's claims, including the PECVD deposition temperature, the types of process gases, the deposition pressure, and the annealing temperature. As such, the annealing process of Ojha et al. would have inherently minimized the presence of Si-O-H-N compounds

in the film, as claimed by the applicant. Please note that the mere observation of still another beneficial result (i.e., that annealing a PECVD silica film specifically reduces Si-O-H-N contaminants in the film, as opposed to contaminants in general) of an old process cannot form the basis of patentability (*Allen et al. v Coe*, 57 USPQ 136).

32. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ojha et al. (USPN 5,904,491) in view of Ngo et al. (USPN 6,127,261), in further view of Chandross et al.

33. The combination of Ojha et al. and Ngo et al. teaches all the limitations of **Claim 22** as set forth above in paragraph 31, except for a method wherein the pressure is maintained by a vacuum pump having a controllable pumping speed, and the total gas pressure is maintained by controlling the pumping speed. Specifically, the combination of Ojha et al. and Ngo et al. is silent as to how the appropriate chamber pressure is maintained. Chandross et al. teaches that it was known in the art of silicon oxide deposition at the time of the applicant's invention to maintain the desired pressure in a vacuum chamber by controlling the pumping speed of a vacuum pump (Col.5, lines 48 – 60). Therefore, it would have been obvious to one of ordinary skill in the art to maintain the desired pressure in the vacuum chamber during the PECVD process by controlling the pumping speed of a vacuum pump, as taught by Chandross et al., with the reasonable expectation of successfully and advantageously maintaining the desired pressure (e.g., 2.4 Torr) by utilizing a well-known, conventional means of doing so.

Response to Arguments

34. Applicant's arguments filed on 9/15/2005 have been fully considered but they are not persuasive. Specifically, the applicant's arguments are moot in view of the new grounds of rejection set forth above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D. Markham whose telephone number is (571) 272-1422. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER

Wesley D Markham
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